NORTHERN ILLINOIS UNIVERSITY

Endocrine Disrupting Compound Levels of the Kishwaukee River near the Northern Illinois University Community

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By

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ABSTRACT (100 – 200 WORDS):

Endocrine disrupting compounds (EDC) are quickly becoming an area of intensifying research across many scientific fields. EDCs come from non-point sources in most cases, but this research aims to narrow the source of at least a portion of the EDC levels present in the Kishwaukee River to the community of students and faculty at Northern Illinois University in De Kalb, Illinois. Our working hypothesis is that detectable levels of EDCs in the effluent of a wastewater treatment place will fluctuate from relatively higher levels during the fall and spring semesters to relatively low levels during winter vacation. We tested for four hormonal compounds that are typically found in birth control medication: 17a-estradiol, 17b-estradiol, estrone, and estriol. Water samples were collected from three sites along the Kishwaukee River which included an upstream (uncontaminated) sample, in the effluent, and downstream. We expect to find a detectable fluctuation from lower levels during vacation to higher levels when school is in session. This would point to the students as being a point source of hormones in the water.

Endocrine Disrupting Compound Levels of the Kishwaukee River near the Northern Illinois University Community

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Abstract

Endocrine disrupting compounds (EDC) are quickly becoming an area of intensifying research across many scientific fields. EDCs come from non-point sources in most cases, but this research aims to narrow the source of at least a portion of the EDC levels present in the Kishwaukee River to the community of students and faculty at Northern Illinois University in De Kalb, Illinois. Our working hypothesis is that detectable levels of EDCs in the effluent of a wastewater treatment place will fluctuate from relatively higher levels during the fall and spring semesters to relatively low levels during winter vacation. We tested for four hormonal compounds that are typically found in birth control medication: 17a-estradiol, 17b-estradiol, estrone, and estriol. Water samples were collected from three sites along the Kishwaukee River which included an upstream (uncontaminated) sample, in the effluent, and downstream. We expect to find a detectable fluctuation from lower levels during vacation to higher levels when school is in session. This would point to the students as being a point source of hormones in the water.

Introduction

Endocrine disrupting compounds (EDCs) are quickly becoming an area of intensifying research across many scientific fields. Recent studies show that if hormone levels are determined to be a health hazard to the community that uses that water, there are options such as oxidation (Huber et al. 2005), ozonation (Ternes et al. 2003), and reverse osmosis (Khan et al., 2004) were effective in reducing the concentration of hormones and could prove to solve the problem of toxicity.

EDCs come from non-point sources in most cases, but this research aims to narrow the source of at least a portion of the EDC levels present in the Kishwaukee River to the community of students and faculty at Northern Illinois University in De Kalb, Illinois.

Our working hypothesis is that detectable levels of EDCs will be found in the samples that are taken, and that those levels will fluctuate from relatively higher levels during the fall and spring semesters to relatively low levels during winter vacation, and although it will not be sampled, summer vacation. We will be testing for four hormonal compounds that are found in birth control medication. These compounds are 17a-estradiol, 17b-estradiol, estrone, and estriol (Figure 1) .

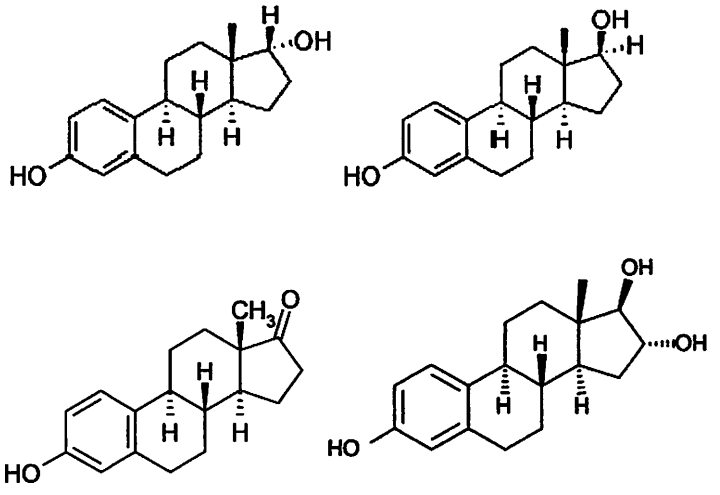


Figure 1: 17a-estradiol (top left), 17b-estradiol (top right), estrone (bottom left), and estriol (bottom right)

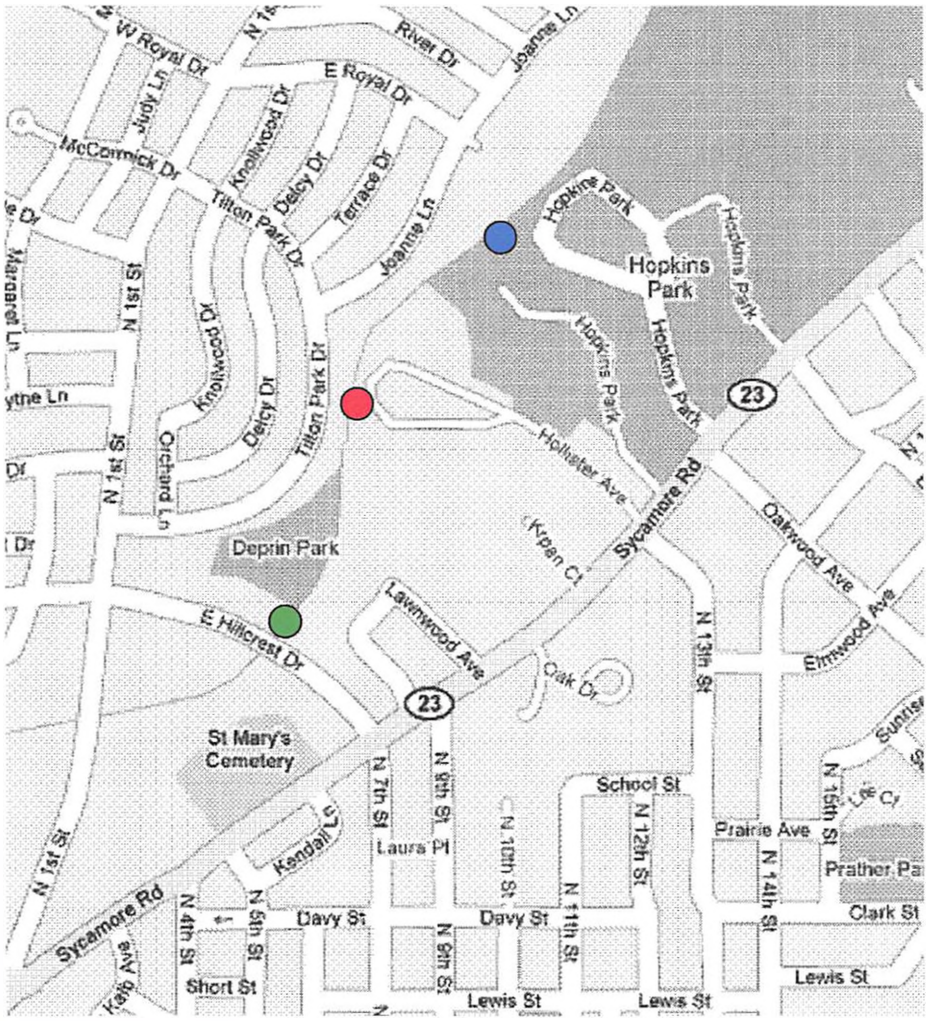
We expect to find a detectable fluctuation from lower levels during vacation to higher levels when school is in session. This would point to the students and faculty as being a point source of hormonal toxicity in the water, and could lead the implementation of more thorough education as to the proper use and disposal of medications containing hormones, such as birth control pills.

The more broad propositions to come from this research could be further treatment for the wastewater in the De Kalb water treatment plant. In the future, hopefully studies such as this one can show that hormonal toxicity in the water is an issue that needs to be addressed by water management systems and legislature. The levels in the water may be low enough to not cause any acute toxicity, but the long term chronic effects continue to be studied (Carlsson et al. 2006, McLachlan et al. 2006) and should be continued to be taken into account when EPA levels are determined.

Methodology

Collection of samples followed a strict regiment which consisted of thrice weekly collection during the last two weeks of the fall semester and the first week of winter vacation, once a week collection for two weeks during winter vacation, and thrice weekly collection during the last week of winter vacation and the first two weeks of the spring semester. There were three collection sites, one at the effluent of the De Kalb water treatment plant, one upstream of the plant under a bridge overpass of the river, and one downstream of the plant near a walking path bridge over the river (Figure 2).

Analysis of the water samples was completed using 250mL of each field sample. Extraction of the 250mL sample was accomplished through the addition of 25mL of methylene chloride in a separatory funnel, straining off the methylene chloride and repeating until 75mL of methylene chloride was used, which led to the concentration step. Concentration of the samples was accomplished using a nitrogen evaporator to reduce the samples to approximately 2mL. The samples were then subjected to derivatization after further reduction to near dryness by a nitrogen evaporator and a solvent exchange to hexane. After derivatization occurred, the samples were analyzed using a gas chromatograph and mass spectrometer to determine the levels of hormones present in the samples and were thus able to be compared to standards previously prepared (Figure 3).



● = Footbridge Collection Site

● = Effluent Collection Site

● = Hillcrest Collection Site

Figure 2: De Kalb map with collection sites marked

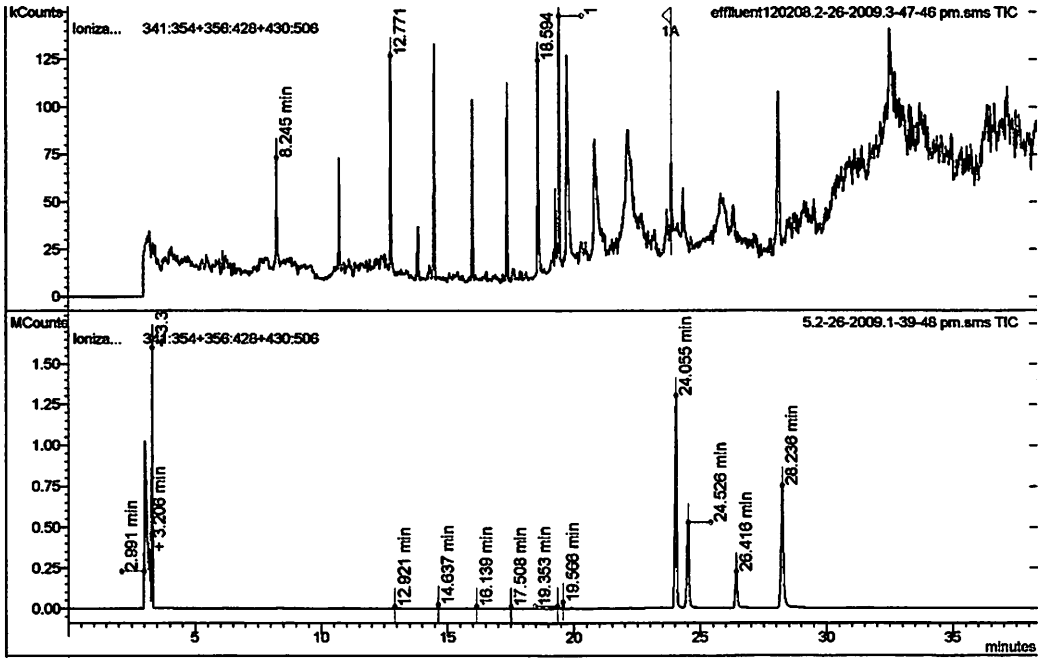
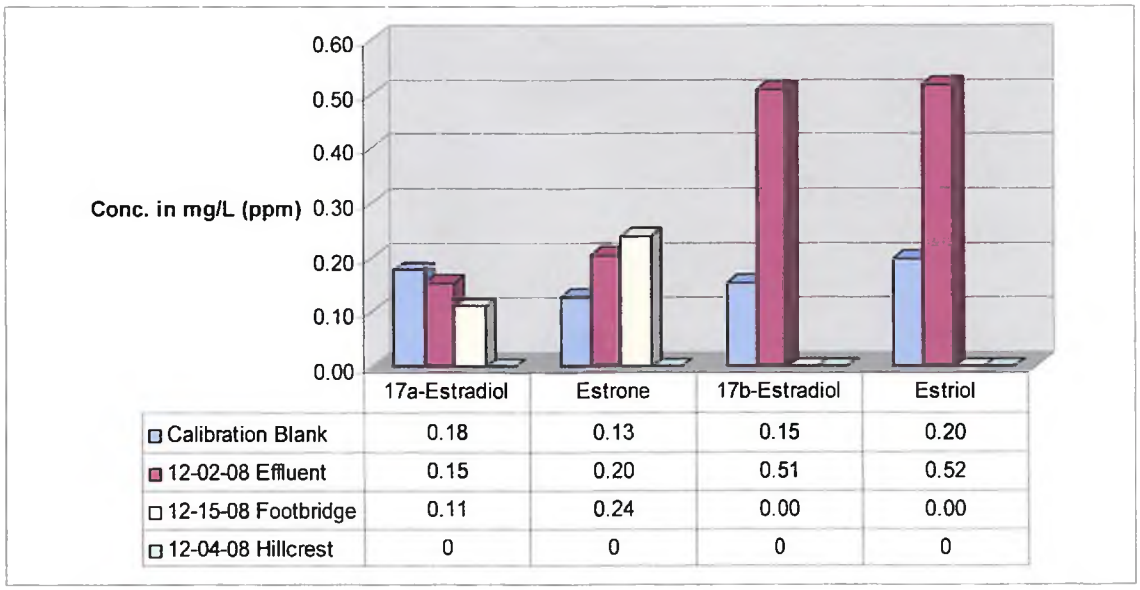


Figure 3: Chromatograph of EDC. Top chromatograph shows the effluent sample from 12-2-08, while the bottom chromatograph shows the calibration standard.

Conclusions and Discussion

Preliminary results show detectable amounts of estrogens at the effluent collection site, but no detectable amounts at either the upstream collection site at the Hillcrest bridge, or the downstream collection site at the pedestrian footbridge (Figure 4). There is data that is yet to be compiled that will show if the levels of estrogens fluctuate from relatively higher levels when school is in session to relatively lower levels when school is not in session. Future studies of the area should concentrate on the ecosystem effects that are present as a result of the hormones being in the water. A recent study in the United Kingdom (Thorpe et al. 2009) saw a reduction of egg production of 50% in fish that had been exposed to hormone concentration levels that were half as concentrated as what was found at the effluent site in De Kalb, so future studies of the Kishwaukee River should

focus on the short-term and long-term effects of the hormones on the fecundity and survival of the aquatic organisms.



	17a-Estradiol	Estrone	17b-Estradiol	Estriol
Calibration Blank	0.18	0.13	0.15	0.20
12-02-08 Effluent	0.15	0.20	0.51	0.52
12-15-08 Footbridge	0.11	0.24	0.00	0.00
12-04-08 Hillcrest	0	0	0	0

Figure 4: Preliminary results of EDC compounds from three locations along the Kishwaukee River.

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